AD-A103 937 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. BALLINGER LAKE DAM (NJ 00583, DELA--ETC(U)
AUG 81 J J WILLIAMS DACW61-79-C-0011

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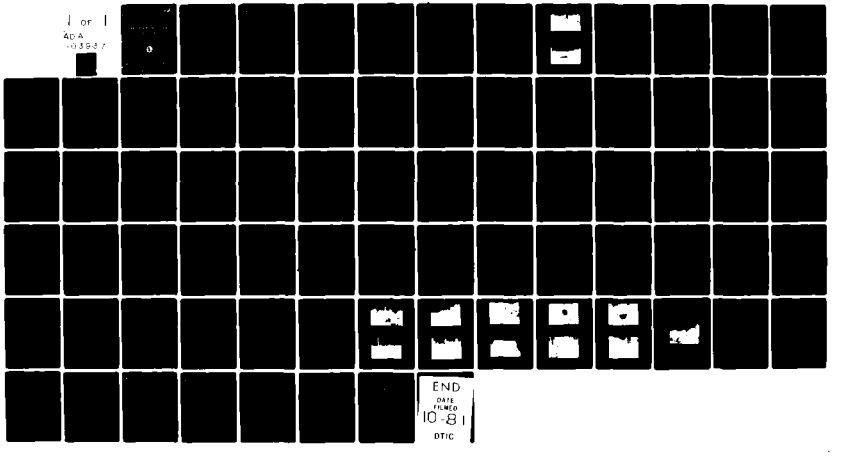

DELAWARE RIVER BASIN
TRIBUTARY OF RANCOCAS CREEK,
BURLINGTON COUNTY
NEW JERSEY

BALLINGER LAKE DAM
NJ 00583

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO: DAEN/NAP-53842/NJ00583-81/08

AUGUST 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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7. AUTHOR(s) Williams, John J., P.E.		8. CONTRACT OR GRANT NUMBER(s) DACW61-79-C-0011
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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Visual Inspection
Structural Analysis
National Dam Safety Program
Ballinger Lake Dam, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

28 AUG 1981

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Department of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Dear Mr. O'Dowd:

We are forwarding, for your information, under separate cover the available copies of the Final Report for Ballinger Lake Dam, NJ00583. Since the dam does not meet the size criteria for inclusion in the National Inventory of Dams, a Corps of Engineers Assessment has not been prepared. The report does, however, provide a valid indication of the condition of the dam.

Sincerely,

1 Incl (14 cys)
As stated fwd sep

D. J. SHERIDAN
Chief, Planning/Engineering Division

DELAWARE RIVER BASIN

Name of Dam: Ballinger Lake Dam
County & State: Burlington County, New Jersey
Inventory Number: NJ 00583

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Ballinger Lake Dam (NJ-00583. Delaware River Basin. Tributary of Rancocas Creek, Burlington County, New Jersey. Phase 1 Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.

For

DEPARTMENT OF THE ARMY
Philadelphia District, Corps of Engineers
Custom House - 2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106

AUG [redacted] 81

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and anlayses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data availabe to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Ballinger Lake Dam NJ 00583
State Located:	New Jersey
County Located:	Burlington
Stream:	Tributary to Rancocas Creek
Coordinates:	N39°51.8', W74°48.5'
Date of Inspection:	April 30, 1981

ASSESSMENT

Based on visual observations made during the inspection, information provided by the New Jersey Department of Environmental Protection (NJDEP) and conversations with the Owner's representatives, Ballinger Lake Dam is considered to be in fair overall condition.

The dam is a U-shaped earth embankment approximately 950 feet long with a maximum height of about 11 feet. County route 541, a two lane asphalt paved road, is located immediately downstream of the northeast portion of the dam. Immediately downstream of the highway is the asphalt paved parking lot of a restaurant. The top width of the dam varies between 8 feet and 20 feet and the upstream and downstream slopes are about 1H:1V and 4H:1V, respectively. The spillway is a concrete drop inlet with a weir length of 17 feet. The freeboard between the spillway crest and the low point of the top of the dam is about 0.8 feet.

A large number of trees and brush are growing on the embankment on the southwest portion of the dam and near the spillway. A lack of vegetative cover was noted along the entire northeast portion of the dam. Some embankment displacement apparently due to foot traffic, was observed adjacent to the right side of the spillway. No seepage from the embankment was observed.

The concrete drop inlet structure appeared to be in good condition, however, considerable trash accumulation was observed at the invert of the structure. The spillway discharge channel was overgrown with trees and brush and a 42-inch diameter road culvert about 100 feet downstream of the dam was found to be obstructed with debris.

The selected Spillway Design Flood (SDF) for this "Small" size, "High" hazard dam is one-half of the Probable Maximum Flood (PMF). Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of discharging approximately 13 percent of the SDF prior to overtopping of the embankment. Failure of the dam would not cause a significant increase in the downstream hazard potential. Therefore, the spillway is classified as "Inadequate".

The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with the following recommendations and remedial measures.

The recommendations and remedial measures should be initiated very soon.

a. Facilities.

1. More detailed hydrologic and hydraulic analyses should be performed to determine the need for and type of mitigating measures required to ensure the adequacy of the spillway.

2. Trees and bushes should be removed from the embankment. Any remaining voids should be filled with a suitable, thoroughly compacted material.

3. Fill in low regions of the crest of the dam to Elevation 60.0 with suitable thoroughly compacted material.

4. A suitable vegetative cover should be established and maintained on the embankment.

5. The outlet channel should be cleared of trees and brush. In addition, consideration should be given to enlarging the road culvert 150 feet downstream of the dam to improve the capacity of the outlet channel.

6. The vertical earth face on the left side of the outlet retaining wall should be sloped back to prevent slope failure and blocking of the outlet pipe.

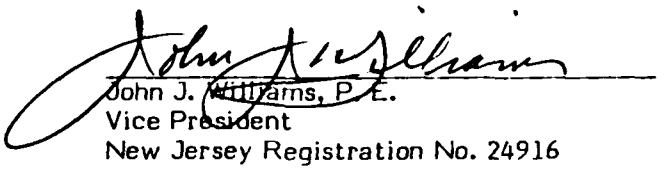
b. Operation and Maintenance Procedures

1. The Owner should institute measures to prevent debris and trash buildup in the spillway drop inlet and on the trashrack.

2. The channel immediately downstream of the dam should be kept clear of obstructions.

3. The Owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

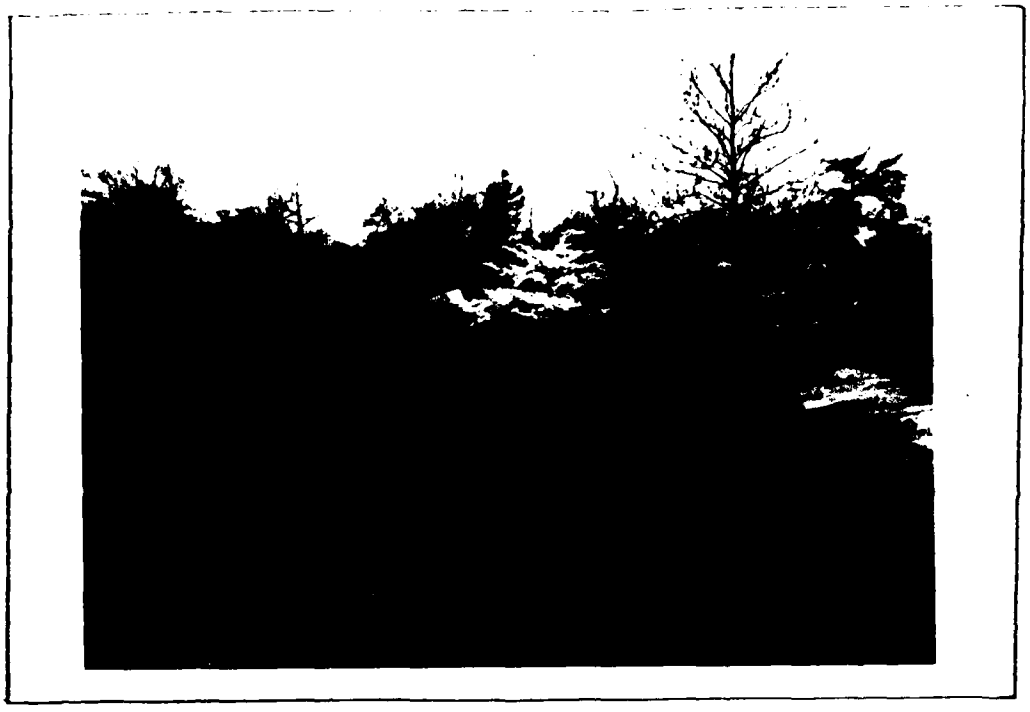
O'BRIEN & GERE ENGINEERS



Date: 8/10/81

John J. Williams, P.E.
Vice President
New Jersey Registration No. 24916

Approved by: _____ Date: _____



OVERVIEW OF IMPOUNDMENT, DROP INLET AND NORTHWEST (RIGHT) AND SOUTHWEST (LEFT) SECTIONS OF EMBANKMENT. (4/30/81)

OVERVIEW OF BALLINGER LAKE. (4/30/81)

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TABLE OF CONTENTS
(Continued)

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM
BALLINGER LAKE DAM
INVENTORY NUMBER - NJ

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract # DACW 61-80-D0013 between O'Brien & Gere Engineers, Inc. and the United States Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection. The purpose of this inspection is to evaluate the structural and hydraulic condition of Ballinger Lake Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 Project Description (Based on information provided by New Jersey Department of Environmental Protection (NJDEP), field observations, and discussions with the Owner's representatives).

a. Description of Dam and Appurtenances. Ballinger Lake Dam is an earth embankment approximately 950 feet in length with a maximum height of about 11 feet. The dam crest width varies from about 8 feet to 20 feet and the side slopes are approximately 1H:1V upstream and 4H:1V downstream. According to information provided by the NJDEP, the U-shaped embankment was constructed of sand and covered with sod. A 90-foot long timber retaining wall of light construction is located on the upstream face of the embankment on the northeast side of the impoundment.

The spillway is a concrete drop inlet, 5 feet wide by 6 feet long, covered by a steel grating. A weir notch, 2.5 feet wide, is located on the upstream (5 feet wide) side of the inlet. Flow through the weir is controlled by stoplogs that extend to the full depth of the structure, about 7.9 feet. A 3-foot square concrete box culvert connects with the base of the downstream wall of the drop inlet. A concrete retaining wall is located at the outlet end of the culvert which is at the downstream side of the embankment. Flow from the box culvert discharges directly into the natural channel downstream of the dam.

b. Location. Ballinger Lake Dam is located on a tributary of the South branch of Rancocas Creek in Medford Township, Burlington County, New Jersey. The site is shown on the USGS Quadrangle entitled "Medford Lakes, N.J." at coordinates N39°51.8', W74°48.5'. A regional location map of Ballinger Lake Dam is included as Figure 1 in Appendix E.

c. Size Classification. Ballinger Lake Dam has a maximum height of 11 feet which places it in the "Small" size dam category (less than 40 feet high). The maximum storage capacity of 26 acre-feet at the low point of the top of the dam also falls within the "Small" size classification (less than 1,000 acre-feet). Ballinger Lake Dam is, therefore, classified as a "Small" size structure.

d. Hazard Classification. A home and auto-repair shop are located within 100 feet of the downstream toe of the dam. A failure of the dam could result in excessive property damage and loss of life at these locations. A restaurant is located northeast of the impoundment at an elevation lower than normal pool. In the event that the dam is overtopped, the restaurant would be inundated. Therefore, Ballinger Lake Dam is classified in the "High" hazard potential category.

e. Ownership. Ballinger Lake Dam is owned by the Medford Lakes Colony Club, Tecumsek Trail, Medford Lakes, New Jersey 08055.

f. Purpose of Dam. Ballinger Lake Dam provides a lake which is used for recreational activities.

g. Design and Construction History. According to the information received from the NJDEP, the dam was constructed in the mid 1920's by the Medford Lakes Corporation as part of a real estate development. No other information is available relative to the design and construction of the dam.

h. Normal Operating Procedures. Operating procedures would consist of removing the stoplogs from the spillway weir notch. No records of operating procedures are available for this site.

1.3 Pertinent Data

a. Drainage Area (Square Mile).

Controlled by Lake Mishe-Mokwa Dam	0.75
Uncontrolled	0.15
Total	0.90

b. Discharge at Dam Site (cfs).

Spillway Capacity	41

c. Elevation (Feet above NGVD).

Spillway Drop Inlet Crest	57.0
Spillway Weir Notch Crest	49.1
Top of Dam (Low Point)	57.8
Invert of Box Culvert Outlet	46.6

d. Reservoir Length (Feet).

Normal Pool	1775
Maximum Pool	1800

e. Reservoir Storage (Acre-Feet).

Normal Pool	21
Maximum Pool	26

f. Reservor Surface Area (Acres).

Normal Pool	6.2
Maximum Pool	7.4

g. Dam Data.

Type	Earth
Length	950 Feet
Height	11 Feet
Top Width	Varies 8 Feet to 20 Feet
Side Slopes: Upstream	1H:1V
Downstream	4H:1V
Zoning	Unknown
Impervious Core	Unknown
Cutoff	Unknown
Grout Curtain	Unknown

h. Spillway Data.

Type	Concrete Drop Inlet
Crest Length	17 Feet
Crest Elevation	57.0
Approach Channel	Impoundment
Downstream Channel	Natural Stream

j. Regulating Outlet.

Timber Stoplogs.
2.5 Feet Long

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. No design data or drawings are available for this structure.

b. Design Features. The principal design features for this structure are discussed in Section 1.2a.

2.2 Construction

The dam was originally constructed in the mid-1920's. However, no further information is available.

2.3 Operation

No operational data is available for this dam.

2.4 Evaluation

a. Availability. All information made available was provided by the NJDEP. No original design or construction information is available.

b. Adequacy. The information made available by the NJDEP, discussions with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Validity. There appears to be no reason to question the validity of the information provided by the NJDEP.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Ballinger Lake Dam took place on April 30, and June 24 1981. At the time of the inspections, the reservoir water surface was a few hundredths of a foot above the spillway crest. No underwater areas were inspected. The observations and comments of the field inspection team are in the checklist which is Appendix B of this report. The appearance of the facility indicates that it is fairly well maintained.

b. Dam. A large number of small trees and brush were observed growing from the embankment on the southwest side of the Lake. The portion of the embankment on the northeast side of the Lake lacks vegetative cover. The only upstream slope protection observed was the 90 feet timber retaining wall along the northeast portion of the embankment. Evidence of embankment settlement was observed along the retaining wall. The freeboard at the time of the inspection averaged about 2 feet; however, the minimum freeboard within the reach of the timber retaining wall is about 0.8 feet. Some erosion, apparently due to foot traffic, was observed adjacent to the right side of the spillway. No seepage was observed coming from the embankment.

c. Appurtenant Structures. The concrete drop inlet structure appeared to be in good condition. On April 30, the stoplogs in the weir notch, were nearly level with the spillway crest and a small amount of discharge was observed. Considerable trash accumulation was observed at the invert of the spillway structure. The trashrack located on the top of the spillway consists of a grating with bars spaced about one inch apart. This spacing will prevent the passage of small debris which could collect on the grating and reduce the spillway capacity signficantly.

d. Reservoir Area. No evidence of excessive sedimentation in the reservoir was observed. The banks of the reservoir are on very gentle slopes. A residential area surrounds the reservoir.

e. Downstream Channel. The downstream channel is about 10 feet wide with 1H:1V side slopes and is heavily overgrown with trees and brush. On the left side of the outlet retaining wall, the earth embankment is vertical. A small road culvert which is located about 150 feet downstream of the dam, is obstructed with vegetation.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

The operating procedures for Ballinger Lake Dam consist of placing and removing the stoplogs from the spillway weir notch. According to the Owner's representative, the reservoir is drawn down each spring.

4.2 Maintenance of Dam

According to the Owner's representative, the dam is inspected each spring and repairs are made as needed. The spring inspection usually includes drawing down the reservoir and replacing ground cover where needed on the embankment. A lack of ground cover is evident on Ballinger Dam.

4.3 Maintenance of Operating Facilities

During the spring inspection, the spillway is cleared of trash and debris. However, the spillway inlet structure had an appreciable amount of debris on its floor at the time of the inspection.

4.4 Description of Any Warning Systems in Effect

According to the Owner's representative, written warning procedures would be implemented in the event of an impending dam failure. The local police department would be contacted and the Medford lake's maintenance crew would contact downstream residents.

4.5 Evaluation of Operational Adequacy

The drop inlet spillway should be kept free of obstructions at all times.

The dam maintenance program should include the removal of trees and brush from the embankment and the maintenance of a suitable vegetative cover.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. No hydrologic or hydraulic design data was included with the information provided by the NJDEP. Ballinger Lake has a total drainage area of 0.90 square miles of which 0.75 square miles is controlled by the Lake Mishe-Mokwa Dam. The drainage basin has a maximum length of about 1.5 miles and an estimated maximum width of one mile. The ground surface in the basin varies from a maximum of approximately El. 150 to El. 57 at normal pool. Roughly 70 percent of the basin is residentially developed with the balance primarily pine woods.

The spillway at Ballinger Lake Dam has an estimated discharge capacity of 41 cfs.

For further information, refer to the calculations and computer printout included in Appendix C of this report.

b. Experience Data. No rainfall or reservoir level records are maintained at this site. According to local residents, the dam was overtopped within the last ten years. At that time, the reservoir rose to within about one foot of the top of the concrete spillway headwall. The northeast portion of the reservoir was overtopped and both the restaurant on that side of the dam and the house downstream of the dam were flooded.

With the impoundment level at normal pool, Elevation 57.0, it would take approximately 2.5 hours to draw the reservoir down about 8 feet to Elevation 49.0 which is the invert of the stop logged drop inlet.

c. Visual Observations. On the date of the inspection, the invert of the drop inlet was partially obstructed with trash and debris. A 42-inch diameter road culvert is located about 150 feet downstream of the dam. A heavy accumulation of debris was observed in the culvert that would greatly reduce its discharge capacity and cause flood water to backup into the hazard area between the road and the dam during high discharges.

d. Overtopping Potential. The recommended Spillway Design Flood (SDF) range for a "Small" size, "High" hazard dam is one-half of the Probable Maximum Flood (PMF) to the full PMF. Due to the small storage capacity of the reservoir, the selected SDF is one-half of the PMF. The SDF was developed from the SCS unit hydrograph using one-half of the computed PMF. The inflow hydrograph to Lake Mishe-Mokwa was routed through the dam and combined with the inflow hydrograph to Ballinger Lake. The resulting SDF hydrograph was routed through Ballinger Lake Dam with the initial water surface elevation at the spillway crest. The peak inflow and outflow rates for the SDF were computed to be about 1540 cfs. The spillway is capable of discharging approximately 13 percent of the SDF prior to overtopping of the embankment (refer to Appendix C for computations and the computer printout).

e. Spillway Adequacy. A dam break analysis was performed to evaluate the "hazard to loss of life downstream from the dam from that which would exist just before overtopping failure" (ETL 1110-2-234, 10 May, 1978). The breach was assumed to occur at approximately 100 percent of the SDF (50 percent of the PMF) with the reservoir surface 1.6 feet above the low point of the top of the dam (2.4 feet above the spillway crest). The flow at the hazard area prior to failure of the dam was computed to be about 1540 cfs with a corresponding flow depth of 6.3 feet (3.3 feet above the channel banks). The breach flow at the hazard area was computed to be about 2540 cfs with a corresponding flow depth of 7.3 feet (4.3 feet above the channel banks). The sill elevation of the lowest house in the hazard area is approximately the same as the elevation of the channel banks. A failure of the dam is not considered to significantly increase the hazard to loss of life downstream. Therefore, the spillway is classified as"Inadequate".

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. The trees growing from the embankment present potential hazards to the structural integrity of the dam. The root systems create seepage paths through the embankment and, if uprooted during severe wind conditions, could remove portions of the embankment. In addition, the dam could be subjected to erosion in the event of overtopping due to the lack of vegetation on the surface of the northeast portion of the embankment.

b. Design and Construction Data. No design or construction data is available for this dam.

c. Operating Records. No operating records are kept for this dam. According to the Owner's representative, the reservoir is usually drawn down each spring for repairs by removing the spillway weir stoplogs.

d. Post Construction Changes. No records of post construction changes have been maintained for this dam.

e. Seismic Stability. Ballinger Lake Dam is located in Seismic Zone 1 on the "Seismic Zone Map of Contiguous States". A dam located in Seismic Zone 1 is generally considered to be safe under expected earthquake loadings in this Zone if it is stable for static loading conditions. Based on the field inspections, Ballinger Lake Dam appears to be stable for static conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. The visual observations and review of available information indicate that Ballinger Lake Dam is in fair condition. The deficiencies and problem areas noted include inadequate spillway capacity and inadequate maintenance.

The selected SDF for this structure is one-half of the PMF. The spillway is capable of discharging approximately 13 percent of the SDF prior to overtopping of the embankment. Failure of the dam by overtopping would not result in a significant increase in the water surface elevation at the hazard area over that which would occur just prior to failure. Therefore, the spillway is classified as "Inadequate".

b. Adequacy of Information. The information obtained from the New Jersey Department of Environmental Protection (NJDEP), conversations with the Owner's representatives and observations made during the field investigations provided adequate data for a Phase I investigation.

c. Urgency. The recommendations and remedial measures described in Section 7.2 should be initiated very soon.

d. Necessity for Further Evaluation. Further investigation should be performed in accordance with Section 7.2a, Item 1.

7.2 Recommendations and Remedial Measures

The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with the following recommendations and remedial measures.

a. Facilities.

1. More detailed hydrologic and hydraulic analyses should be performed to determine the need for and type of mitigating measures required to ensure the adequacy of the spillway.

2. Trees and bushes should be removed from the embankment. Any remaining voids should be filled with a suitable, thoroughly compacted material.

3. Fill in low regions of the crest of the dam to Elevation 60.0 with suitable thoroughly compacted material.

4. A suitable vegetative cover should be established and maintained on the embankment.

5. The outlet channel should be cleared of trees and brush. In addition, consideration should be given to enlarging the road culvert 150 feet downstream of the dam to improve the capacity of the outlet channel.

6. The vertical earth face on the left side of the outlet retaining wall should be sloped back to prevent slope failure and blocking of the outlet pipe.

b. Operation and Maintenance Procedures

1. The Owner should institute measures to prevent debris and trash buildup in the spillway drop inlet and on the trashrack.

2. The channel immediately downstream of the dam should be kept clear of obstructions.

3. The Owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Ballinger Lake Dam

ID # NJ 00583

ITEM	REMARKS
AS-BUILT DRAWINGS	None Available.
REGIONAL VICINITY MAP	Refer to Appendix E
CONSTRUCTION HISTORY	The dam was originally constructed during the mid-1920's.
TYPICAL SECTIONS OF DAM	Refer to Appendix E.
OUTLETS - PLAN	Refer to Appendix E.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	None Available.
RAINFALL/RESERVOIR RECORDS	None Available.

ITEM	REMARKS
DESIGN REPORTS	None Available.
GEOLOGY REPORTS	None provided. Refer to Appendix F.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No data available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No information available.
POST-CONSTRUCTION SURVEYS OF DAM	None known of.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	Dam is monitored during large storms by the Medford Lakes Colony Club maintenance crew.
MODIFICATIONS	Unknown.
HIGH POOL RECORDS	According to Local residents, the dam was overtopped once during the last 10 years.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known of.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known of.
MAINTENANCE OPERATION RECORDS	None available.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Appendix E.
OPERATING EQUIPMENT PLANS & DETAILS	None available.
MISCELLANEOUS	

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Ballinger Lake Dam County Burlington State New Jersey National ID # NJ 00583

Type of Dam Earth Hazard Category High

Date(s) Inspection 4/30/81 & 6/24/81 Weather Cloudy/Rain (4/30/81) Temperature 60°F (4/30/81)

Pool Elevation at Time of Inspection 57.0 NGVD (4/30/81) Tailwater at Time of Inspection ±47 NGVD (4/30/81)

Inspection Personnel:

Len Beck
Dick Horvath
Jon Rauschkolb
Lee DeHeer (6/24/81)

Dick Horvath Recorder

Remarks:

The Medford Lakes maintenance crew met with us to discuss the site.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Some erosion observed adjacent to the right side of the spillway outlet wing wall, due to foot traffic.	Discourage foot traffic in this area.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Satisfactory.	
RIPRAP FAILURES	No riprap protection was observed on the upstream slope of the embankment.	Consideration should be given to installing riprap to protect the slopes against erosion.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS	None Observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Satisfactory.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	2.5 ft. wide by 7.9 ft. deep weir with stoplogs on the upstream wall of the drop inlet.	
OUTLET STRUCTURE	3 ft. x 3 ft. concrete box culvert.	
OUTLET CHANNEL	Natural Stream.	
EMERGENCY GATE	Stoplogs.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	5 ft. by 6 ft. box drop inlet, 7.9 ft. deep. Structure is covered by a steel grating trash rack. Trash accumulated at the invert of the structure.	Concrete is in good condition. Trash should be removed from the invert.
APPROACH CHANNEL	Impoundment	
DISCHARGE CHANNEL	3 ft. by 3 ft concrete box culvert discharges into natural stream.	
BRIDGE AND PIERS	None.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat, vary between 1 and approximately 5 percent.	
SEDIMENTATION	No evidence of excessive sedimentation was observed in the reservoir.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	10 ft. wide channel overgrown with trees and brush. Channel leads to a 42-inch diameter culvert beneath a road about 150 feet downstream of dam. Culvert is obstructed with debris.	At high discharges flood water would back up between the dam and the road. Culvert should be cleaned out. Larger road culvert is needed.
SLOPES	Side slopes average about 1H:1V. Channel invert slope is less than one percent.	
APPROXIMATE NO. OF HOMES AND POPULATION	One residence and a gas station are located immediately downstream of the dam. A restaurant located northeast of the impoundment would be inundated if reservoir overtopped its banks.	

APPENDIX

C

Hydrologic & Hydraulic Data

BALLINGER LAKE DAM
APPENDIX C
HYDROLOGY AND HYDRAULICS DATA

TABLE OF CONTENTS

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	1	JFR	6-12-81	1800-006-114

✓ # 6/18/81

HYDROLOGY / HYDRAULICS

TOTAL DRAINAGE AREA = 0.90 S.M.
D.A. CONTROLLED BY LAKE MISHE-MOKWA = 0.75 S.M.
UNCONTROLLED D.A. = 0.15 S.M.

STAGE - AREA DATA - BALLINGEL LAKE

ELEV.	AREA
47	0 ACRES
57 (N.P.)	6.2
60	12.2
70	47.4

PMP DATA - HMS REPORT 33

STORM DISTRIBUTION

HR.	%
6	113
12	124
24	132
48	142

D.A. is in Zone 6 of the PMP
ALL Season Envelope

24 hr, 200 S.M. Rainfall = 23.8"

SCS LAG TIME - UNCONTROLLED D.A.

UPLAND METHOD:

Greatest Hydraulic Distance = 1500'

Avg. Slope = (80-57)/1500 = 1.53%

Velocity = 1.85 fps (SCS Handbook, Hydrology) Pg 15-8, Fig 15-2, Grassed w/ some wdy

$T_c = \frac{1500}{1.85}$ = 811 sec, L = .6 (811) = 487 sec = 0.14 HR.

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	2	JFR	6-12-81	1800-006-114

1 of 6/1F/81

SCS CURVE NO. METHOD :

$$L = \frac{\ell^{.8}(S+1)^{.7}}{1900\,Y^{.5}}$$

$$S = \frac{1000}{CN} - 10 = \frac{1000}{80} - 10 = 2.5$$

$$L = \frac{(1500)^{.8}(3.5)^{.7}}{1900\,(1.5)^{.5}} = 0.36 \text{ HRS.}$$

CALIFORNIA HWYS. METHOD :

$$T_c = \left(\frac{11.9\,L^3}{H}\right)^{.385}$$

$$= \left(\frac{11.9(0.28)^3}{(80-57)}\right)^{.385} = 0.18 \text{ HRS.}$$

$$L = 0.6\,(.18) = 0.11 \text{ HRS.}$$

KERBY METHOD :

$$T_c = \left(\frac{2}{3}\,\frac{Ln}{\sqrt{S}}\right)^{.467}$$

$$= \left(\frac{2}{3}\,\frac{(1500)(.03)}{\sqrt{.015}}\right)^{.385} = 8.3 \text{ MIN}$$

$$L = 0.6\,(8.3/60) = 0.08 \text{ HRS.}$$

USE $L = \underline{0.14}$ HRS. FOR UNCONTROLLED D.A.

SCS Upland Method

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	3	JFR	6-12-81	1800-006-114

JFR 6/15/81

STAGE DISCHARGE DATA - BALLINGER LAKE

W.S. ELEV.	WEIR DISCHARGE* H (FT)	WEIR DISCHARGE* Q_w (CFS)	INLET CONTROL** HW (FT)	INLET CONTROL** Q_I (CFS)	DISCHARGE (CFS)
57	0	0	7.9	—	0
58	1	51	8.9	114	51
59	2	144	9.9	120	120
60	3	265	10.9	129	129
61	4		11.9	138	138
62	5		12.9	144	144
63	6		13.9	150	150
64	7		14.9	159	159
65	8		15.9	165	165
66	9		16.9	170	170

FOR DAM OVERTOPPING, $C_w = 2.6$ & $L_{MAX} = 947'$.

* $Q_w = C L H^{3/2}$, WHERE $C = 3.0$ (Broad crested weir/trash rack)
$L = 17'$
H = W.S.E. above weir crest el. 57

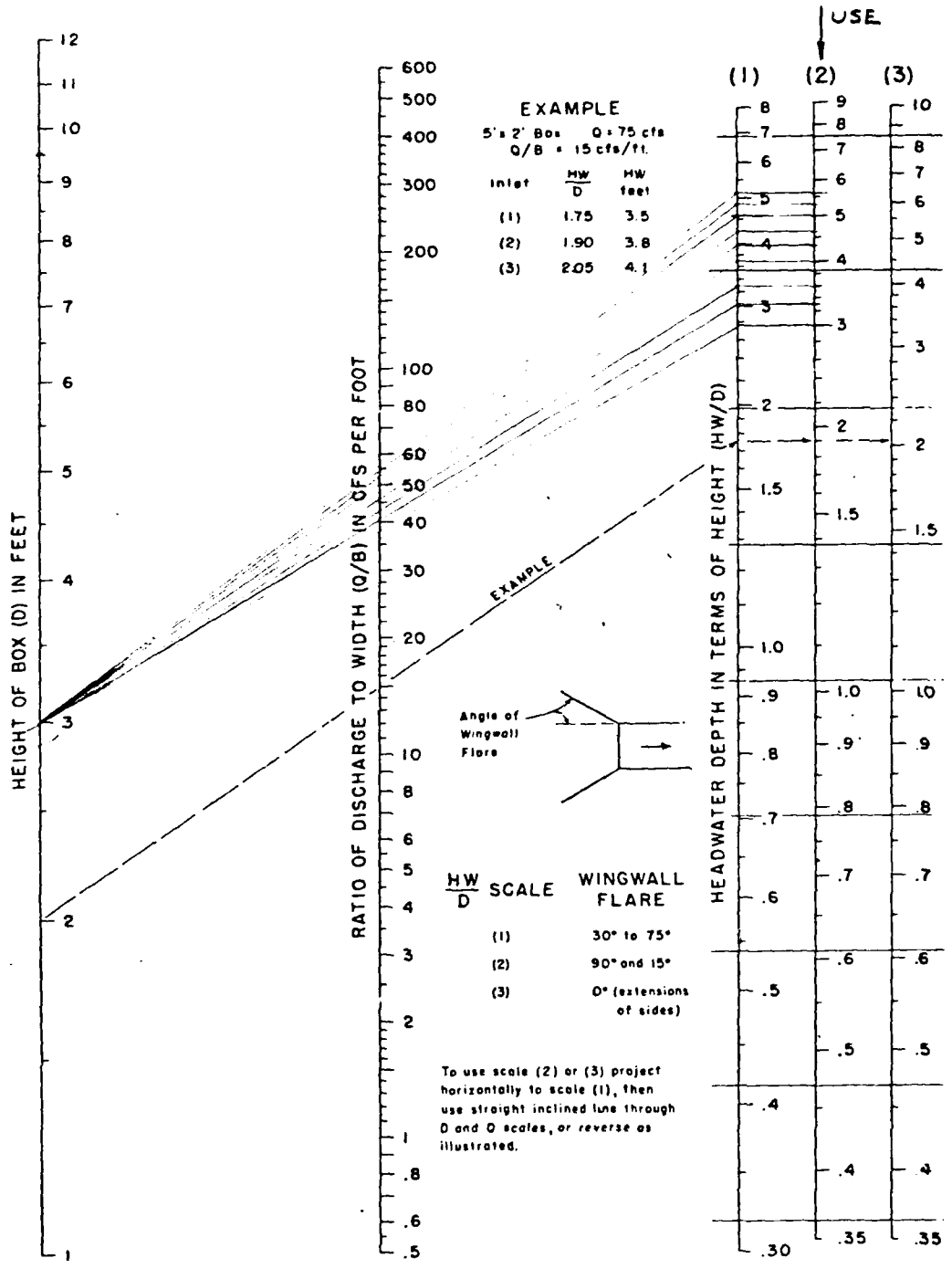
** SEE NOMOGRAPH ON PAGE 4
HW = W.S.E. above culvert invert el. 49.1
$D = 3'$

LAKE MISHE - MOKWA

ALL DATA RELATIVE TO THE DRAINAGE AREA CONTROLLED BY LAKE MISHE-MAKWA DAM WAS OBTAINED FROM THE PHASE I REPORT ON THAT DAM PROVIDED BY PHILA. COE.

SHEET 4

CHART I



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

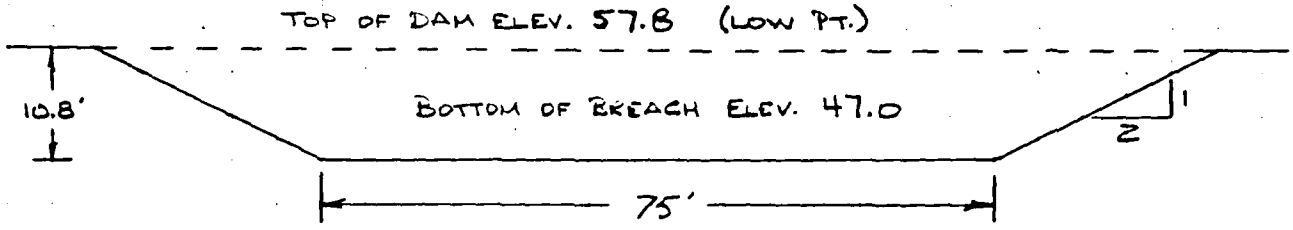
BUREAU OF PUBLIC ROADS JAN 1963

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	5	JFR	6-15-81	1800-006-114

✓ 6-16-81

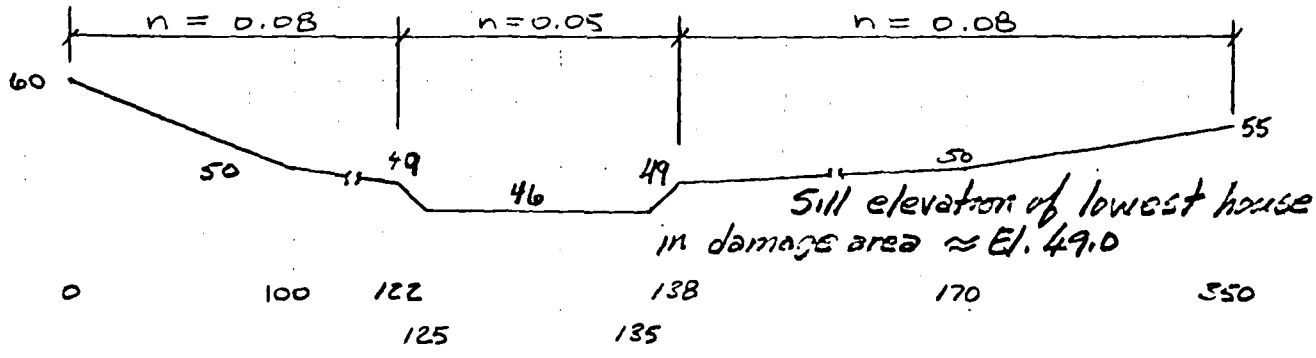
BREACH CONFIGURATION



WATER SURFACE ELEV. AT WHICH BREACH BEGINS ≈ 59.4

TIME FOR BREACH TO REACH MAXIMUM SIZE = 1 HOUR

CHANNEL CROSS-SECTION AT HAZARD AREA



REACH LENGTH = 100'

$$\text{SLOPE} = \frac{47-46}{100} = 0.01 \ \frac{\text{ft}}{\text{ft}}$$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Beaver Lake Dam	5A	[illegible]	8/1/81	1300-006-114

Reservoir Drawdown Calculations

Normal Pool Storage ≈ 21 A.F. (Sh 11, App C)

Normal Pool Surface El. 57.0

Invert of Stop Logs ≈ El. 49.0

Base flow - D.A. ≈ 1.5 csm x 0.9 mi² ≈ 1.4 cfs.

Ave. discharge between El. 57 & El. 49

$Q = CA\sqrt{2gh}$

C ≈ 0.8 (Fig 4.3B, Chart 4 Thin square connected entrance, culvert)

A = 7 ft²

h_{ave} ≈ 4'

$Q = 0.8 \times 7 \times 8.02 \times 2$

Q ≈ 115 cfs. USE Q ≈ 113 cfs. (Assume 2 cfs base flow)

Time to drawdown from El. 57 to El 49.

$$= \frac{21 \text{ A.F.} \times 43560 \text{ ft}^3/\text{Ac}}{113 \text{ ft}^3/\text{sec} \times 3600 \text{ sec/hr}^2}$$

≈ 2.5 hrs. Assuming all stop logs removed.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  01 APR 80
**********
   1  A1                              NATIONAL DAM SAFETY PROGRAM
   2  A2                                BALLINGER LAKE DAM
   3  A3                                  PMF HYDROGRAPH
   4  B   300     0     10     0     0     0     0     0     4     0
   5  B1    5
   6  J     1     6      1
   7  J1  .02   .04   .06   .08   .10   .50
   8  K     0  LAKE      0     0     0     0     1
   9  K1                    INFLOW HYDROGRAPH TO LAKE MISHE-MOKWA
  10  M     1    -2    .75                .90                                1
  11  P     0  23.8   113   124   132   142
  12  T                                                        1.0    .05
  13  W2          .72
  14  X  -1.5  -.05     2
  15  K     1   DAM      0     0     0     0     1
  16  K1                ROUTE DISCHARGE THROUGH LAKE MISHE-MOKWA DAM
  17  Y                                 1     1
  18  Y1    1                                                -70.1    -1
  19  Y4 70.1  70.2  70.4  70.6  70.8    71  71.2  71.4  71.6  71.8
  20  Y4   72  72.2  72.4    74
  21  Y5    0    .3   2.4   8.7    18    29    42   105   208   338
  22  Y5  490   658   844  2632
  23  $A    0    48  57.6  70.5
  24  $E   62  70.1  71.3  72.4
  25  $$ 70.1
  26  $D 72.4  2.63   1.5   165
  27  K     0  LAKE      0     0     0     0     1
  28  K1                    INFLOW HYDROGRAPH TO BALLINGER LAKE
  29  M     1     2    .15                .90
  30  P     0  23.8   113   124   132   142
  31  T                                                        1.0    .05
  32  W2          .14
  33  X  -1.5  -.05     2
  34  K     2  LAKE      0     0     0     0     1
  35  K1          COMBINE DISCHARGE FROM MISHE-MOKWA AND RUNOFF TO BALLINGER
  36  K     1   DAM      0     0     0     0     1
  37  K1                ROUTE DISCHARGE THROUGH BALLINGER LAKE DAM
  38  Y                                 1     1
  39  Y1    1                                                -57    -1
  40  Y4   57    58    59    60    61    62    63    64    65    66
  41  Y5    0    51   120   129   138   144   150   159   165   170
  42  $A    0   6.2  12.2  47.4
  43  $E   47    57    60    70
  44  $$   57
  45  $D 57.8   2.6   1.5   947
  46  $L    0    87   153   226   460   760   940   947
  47  $V 57.8  58.0  58.4  58.6  59.2  59.6  60.2  60.3
  48  K    99
   1                PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                     RUNOFF HYDROGRAPH AT        LAKE
                     ROUTE HYDROGRAPH TO         DAM
                     RUNOFF HYDROGRAPH AT        LAKE
                     COMBINE  2 HYDROGRAPHS AT   LAKE
                     ROUTE HYDROGRAPH TO         DAM
                     END OF NETWORK
```

SHEET 6

NATIONAL DAM SAFETY PROGRAM
BALLINGER LAKE DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= .02 .04 .06 .08 .10 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO LAKE MISHE-MOKWA

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TPSIA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.75	0.00	.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	113.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .72

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	27.04	24.64	2.40	72401.
										(687.)(626.)(61.)(2050.17)			

SHEET 7

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH LAKE MISHE-MOKWA DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTPL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-70.	-1

STAGE	70.10	70.20	70.40	70.60	70.80	71.00	71.20	71.40	71.60	71.80
	72.00	72.20	72.40	74.00						
FLOW	0.00	.30	2.40	8.70	18.00	29.00	42.00	105.00	208.00	338.00
	490.00	658.00	844.00	2632.00						
SURFACE AREA=	0.	48.	58.	71.						
CAPACITY=	0.	130.	193.	263.						
ELEVATION=	62.	70.	71.	72.						

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
70.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
72.4	2.6	1.5	165.

PEAK OUTFLOW IS 4. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 17. AT TIME 43.17 HOURS

PEAK OUTFLOW IS 32. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 67. AT TIME 42.67 HOURS

PEAK OUTFLOW IS 120. AT TIME 42.33 HOURS

PEAK OUTFLOW IS 1397. AT TIME 40.83 HOURS

SHEET 8

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO BALLINGER LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.15	0.00	.90	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	113.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .14

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	27.04	24.64	2.40	14979.
										(687.)	(626.)	(61.)	(424.16)

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE DISCHARGE FROM MISHE-MOKWA AND RUNOFF TO BALLINGER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	2	0	0	0	0	1	0	0

SHEET 9

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH BALLINGER LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-57.	-1

STAGE	57.00	58.00	59.00	60.00	61.00	62.00	63.00	64.00	65.00	66.00
FLOW	0.00	51.00	120.00	129.00	138.00	144.00	150.00	159.00	165.00	170.00
SURFACE AREA=	0.	6.	12.	47.						
CAPACITY=	0.	21.	48.	327.						
ELEVATION=	47.	57.	60.	70.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
57.8	2.6	1.5	947.

CREST LENGTH	0.	87.	153.	226.	460.	760.	940.	947.
AT OR BELOW ELEVATION	57.8	58.0	58.4	58.6	59.2	59.6	60.2	60.3

PEAK OUTFLOW IS 11. AT TIME 40.17 HOURS

PEAK OUTFLOW IS 22. AT TIME 42.17 HOURS

PEAK OUTFLOW IS 38. AT TIME 42.17 HOURS

PEAK OUTFLOW IS 71. AT TIME 42.83 HOURS

PEAK OUTFLOW IS 134. AT TIME 42.17 HOURS

PEAK OUTFLOW IS 1543. AT TIME 40.83 HOURS

SHEET 10

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .02	RATIO 2 .04	RATIO 3 .06	RATIO 4 .08	RATIO 5 .10	RATIO 6 .50
HYDROGRAPH AT	LAKE	.75	1	73.	146.	219.	292.	365.	1827.
		(1.94)		(2.07)(	4.14)(	6.21)(	8.28)(	10.35)(	51.73)(
ROUTED TO	DAM	.75	1	4.	17.	32.	67.	120.	1397.
		(1.94)		(.12)(	.47)(	.91)(	1.90)(	3.39)(	39.56)(
HYDROGRAPH AT	LAKE	.15	1	28.	56.	84.	111.	139.	697.
		(.39)		(.79)(	1.58)(	2.37)(	3.16)(	3.95)(	19.73)(
2 COMBINED	LAKE	.90	1	29.	58.	91.	124.	159.	1541.
		(2.33)		(.81)(	1.65)(	2.57)(	3.52)(	4.49)(	43.62)(
ROUTED TO	DAM	.90	1	11.	22.	38.	71.	134.	1543.
		(2.33)		(.30)(	.62)(	1.06)(	2.00)(	3.81)(	43.70)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	70.10	70.10	72.40
STORAGE	130.	130.	263.
OUTFLOW	0.	0.	844.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.02	70.46	0.00	148.	4.	0.00	43.50	0.00
.04	70.72	0.00	164.	17.	0.00	43.17	0.00
.06	71.05	0.00	179.	32.	0.00	43.00	0.00
.08	71.28	0.00	192.	67.	0.00	42.67	0.00
.10	71.43	0.00	200.	120.	0.00	42.33	0.00
.50	72.80	.40	292.	1397.	2.17	40.83	0.00

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	57.00	57.00	57.80
STORAGE	21.	21.	26.
OUTFLOW	0.	0.	41.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.02	57.21	0.00	22.	11.	0.00	40.17	0.00
.04	57.43	0.00	23.	22.	0.00	42.17	0.00
.06	57.74	0.00	26.	38.	0.00	42.17	0.00
.08	58.05	.25	28.	71.	7.00	42.83	0.00
.10	58.26	.46	30.	134.	8.50	42.17	0.00
.50	59.49	1.69	42.	1543.	13.67	40.83	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80
****
RUN COMPLETED.

SHEET 11

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1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION -  JULY 1978
   LAST MODIFICATION  01 APR 80
 **********
    1                A1    NATIONAL DAM SAFETY PROGRAM
    2                A2    BALLINGER LAKE DAM
    3                A3    BREACH ROUTING
    4                B   300      0     10      0      0      0      0      0     -4      0
    5                B1    5
    6                J     2      1      1
    7                J1   .5
    8                K     0   LAKE      0      0      0      0      1
    9                K1     INFLOW HYDROGRAPH TO LAKE MISHE-MONWA
   10                M     1      2    .75                 .90                        1
   11                P     0   23.8    113    124    132    142
   12                T                                                 1.0    .05
   13                W2          .72
   14                X  -1.5   -.05      2
   15                K     1    DAM      0      0      0      0      1
   16                K1     ROUTE DISCHARGE THROUGH LAKE MISHE-MONWA DAM
   17                Y                             1      1
   18                Y1    1                                          -70.1     -1
   19                Y4 70.1   70.2   70.4   70.6   70.8     71   71.2   71.4   71.6   71.8
   20                Y4   72   72.2   72.4     74
   21                Y5    0     .3    2.4    8.7     18     29     42    105    208    338
   22                Y5  490    658    844   2632
   23                $A    0     48   57.6   70.5
   24                $E   62   70.1   71.3   72.4
   25                $$ 70.1
   26                $D 72.4   2.63    1.5    165
   27                K     0   LAKE      0      0      0      0      1
   28                K1     INFLOW HYDROGRAPH TO BALLINGER LAKE
   29                M     1      2    .15                 .90                        1
   30                P     0   23.8    113    124    132    142
   31                T                                                 1.0    .05
   32                W2          .14
   33                X  -1.5   -.05      2
   34                K     2   LAKE      0      0      0      0      1
   35                K1     COMBINE DISCHARGE FROM MISHE-MONWA AND RUNOFF TO BALLINGER
   36                K     1    DAM      0      0      0      0      1
   37                K1     ROUTE DISCHARGE THROUGH BALLINGER LAKE DAM
   38                Y                             1      1
   39                Y1    1                                          -57     -1
   40                Y4   57     58     59     60     61     62     63     64     65     66
   41                Y5    0     51    120    129    138    144    150    159    165    170
   42                $A    0    6.2   12.2   47.4
   43                $E   47     57     60     70
   44                $$   57
   45                $D 57.8    2.6    1.5    947
   46                $L    0     87    153    226    460    760    940    947
   47                $V 57.8   58.0   58.4   58.6   59.2   59.6   60.2   60.3
   48                $R   75      2     47      1     57     60
   49                $R   75      2     47      1     57   59.4
   50                K     1 HAZARD      0      0      0      0      1
1  51                K1     ROUTE DAM OUTFLOW TO HAZARD AREA
   52                Y                             1      1
   53                Y1    1                                          -1
   54                Y6  .08    .05    .08     46     55    100    .01
   55                Y7    0     40    100     50    122     49    125     46    135    .46
   56                Y7  138     49    170     50    350     55
   57                K    99
1                  PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                   RUNOFF HYDROGRAPH AT        LAKE
                   ROUTE HYDROGRAPH TO          DAM
                   RUNOFF HYDROGRAPH AT        LAKE
                   COMBINE  2 HYDROGRAPHS AT   LAKE
                   ROUTE HYDROGRAPH TO          DAM
                   ROUTE HYDROGRAPH TO       HAZARD
                   END OF NETWORK
```

SHEET 12

RUN DATE= 81/06/16.
TIME= 10.00.23.

NATIONAL DAM SAFETY PROGRAM
BALLINGER LAKE DAM
BREACH ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 1 LRTIO= 1

RTIOS= .50

****

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO LAKE MISHE-MOKWA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.75	0.00	.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	113.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .72

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
						0

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
		SUM	27.04	24.64	2.40	72401.
			(.80)	(.73)	(.1)	(2150.1)

SHEET 13

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH LAKE MISHE-MOKWA DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	.0.000	0.000	-70.	-1

STAGE	70.10	70.20	70.40	70.60	70.80	71.00	71.20	71.40	71.60	71.80
	72.00	72.20	72.40	74.00						
FLOW	0.00	.30	2.40	8.70	18.00	29.00	42.00	105.00	208.00	338.00
	490.00	658.00	844.00	2632.00						
SURFACE AREA=	0.	48.	58.	71.						
CAPACITY=	0.	130.	193.	263.						
ELEVATION=	62.	70.	71.	72.						

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
70.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
72.4	2.6	1.5	165.

PEAK OUTFLOW IS 1397. AT TIME 40.83 HOURS

PEAK OUTFLOW IS 1397. AT TIME 40.83 HOURS

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO BALLINGER LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.15	0.00	.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	113.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .14

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	27.04	24.64	2.40	14979.
										(687.)	(626.)	(61.)	(-424.16)

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE DISCHARGE FROM MISHE-MOKWA AND RUNOFF TO BALLINGER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	2	0	0	0	0	1	0	0

SHEET 15

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH BALLINGER LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-57.	-1

STAGE	57.00	58.00	59.00	60.00	61.00	62.00	63.00	64.00	65.00	66.00
FLOW	0.00	51.00	120.00	129.00	138.00	144.00	150.00	159.00	165.00	170.00
SURFACE AREA=	0.	6.	12.	47.						
CAPACITY=	0.	21.	48.	327.						
ELEVATION=	47.	57.	60.	70.						

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
57.8	2.6	1.5	947.

CREST LENGTH AT OR BELOW ELEVATION	0.	87.	153.	226.	460.	760.	940.	947.
	57.8	58.0	58.4	58.6	59.2	59.6	60.2	60.3

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
75.	2.00	47.00	1.00	57.00	60.00

PEAK OUTFLOW IS 1543. AT TIME 40.83 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
75.	2.00	47.00	1.00	57.00	59.40

BEGIN DAM FAILURE AT 40.50 HOURS

PEAK OUTFLOW IS 2559. AT TIME 41.13 HOURS

SHEET 16

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DAM OUTFLOW TO HAZARD AREA

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAZARD		1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0500	.0800	46.0	55.0	100.	.01000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 60.00 100.00 50.00 122.00 49.00 125.00 46.00 135.00 46.00
138.00 49.00 170.00 50.00 350.00 55.00

STORAGE	0.00	.01	.02	.04	.05	.07	.08	.11	.16	.23
	.34	.46	.61	.78	.98	1.20	1.44	1.71	2.00	2.31
OUTFLOW	0.00	8.52	27.03	53.32	86.73	126.97	174.00	235.68	322.02	443.15
	607.03	819.42	1086.48	1414.09	1807.85	2273.12	2815.07	3438.69	4148.82	4950.18
STAGE	46.00	46.47	46.95	47.42	47.89	48.37	48.84	49.32	49.79	50.26
	50.74	51.21	51.68	52.16	52.63	53.11	53.58	54.05	54.53	55.00
FLOW	0.00	8.52	27.03	53.32	86.73	126.97	174.00	235.68	322.02	443.15
	607.03	819.42	1086.48	1414.09	1807.85	2273.12	2815.07	3438.69	4148.82	4950.18

MAXIMUM STAGE IS 52.3

MAXIMUM STAGE IS 53.3

SHEET 17

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .50
HYDROGRAPH AT	LAKE	.75	1	1827.
		(1.94)		(51.73)(
			2	1827.
				(51.73)(
ROUTED TO	DAM	.75	1	1397.
		(1.94)		(39.56)(
			2	1397.
				(39.56)(
HYDROGRAPH AT	LAKE	.15	1	697.
		(.39)		(19.73)(
			2	697.
				(19.73)(
2 COMBINED	LAKE	.90	1	1541.
		(2.33)		(43.62)(
			2	1541.
				(43.62)(
ROUTED TO	DAM	.90	1	1543.
		(2.33)		(43.70)(
			2	2540.
				(71.92)(
ROUTED TO	HAZARD	.90	1	1541.
		(2.33)		(43.65)(
			2	2537.
				(71.83)(

SHEET 18

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	70.10	70.10	72.40
STORAGE	130.	130.	263.
OUTFLOW	0.	0.	844.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	72.80	.40	292.	1397.	2.17	40.83	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	70.10	70.10	72.40
STORAGE	130.	130.	263.
OUTFLOW	0.	0.	844.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	72.80	.40	292.	1397.	2.17	40.83	0.00

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	57.00	57.00	57.80
STORAGE	21.	21.	26.
OUTFLOW	0.	0.	41.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	59.49	1.69	42.	1543.	13.67	40.83	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	57.00	57.00	57.80
STORAGE	21.	21.	26.
OUTFLOW	0.	0.	41.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	59.44	1.64	41.	2559.	4.73	41.13	40.50

PLAN 1 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1541.	52.3	40.83

PLAN 2 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2537.	53.3	41.17

SHEET 19

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80
****

APPENDIX

D

Photographs

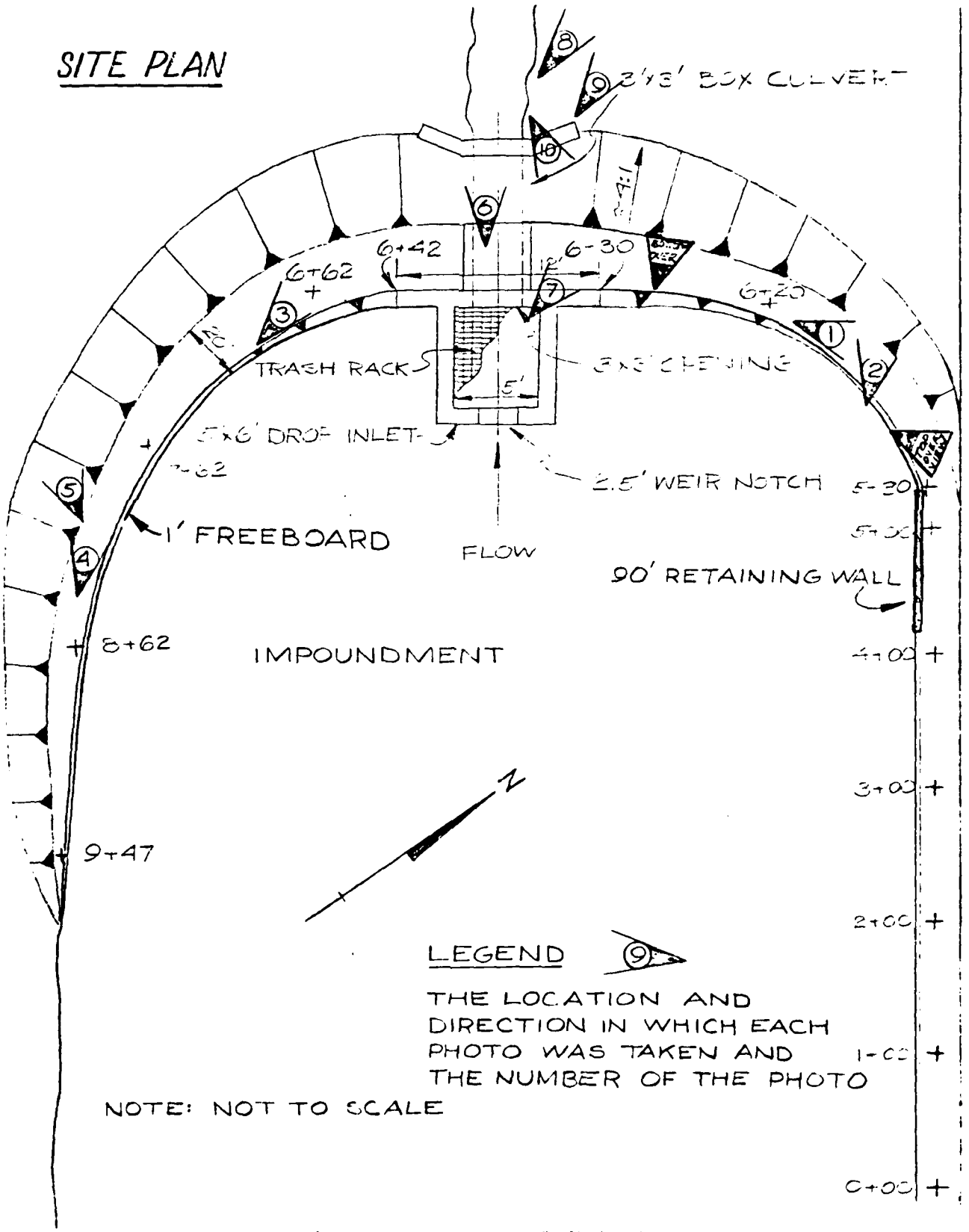
APPENDIX D

PHOTOGRAPHS

O'BRIEN & GERE
ENGINEERS, INC

SUBJECT	SHEET	BY	DATE	JOB NO.
BALLINGER LAKE DAM	A	RAB	6/18/81	1800-006-114

SITE PLAN

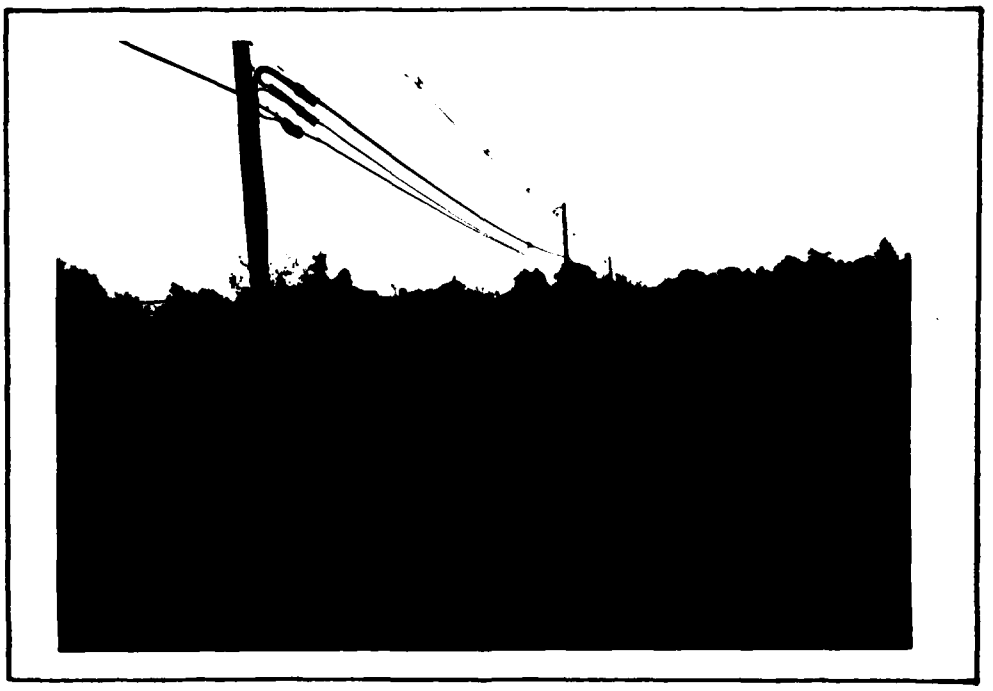


LEGEND (9)

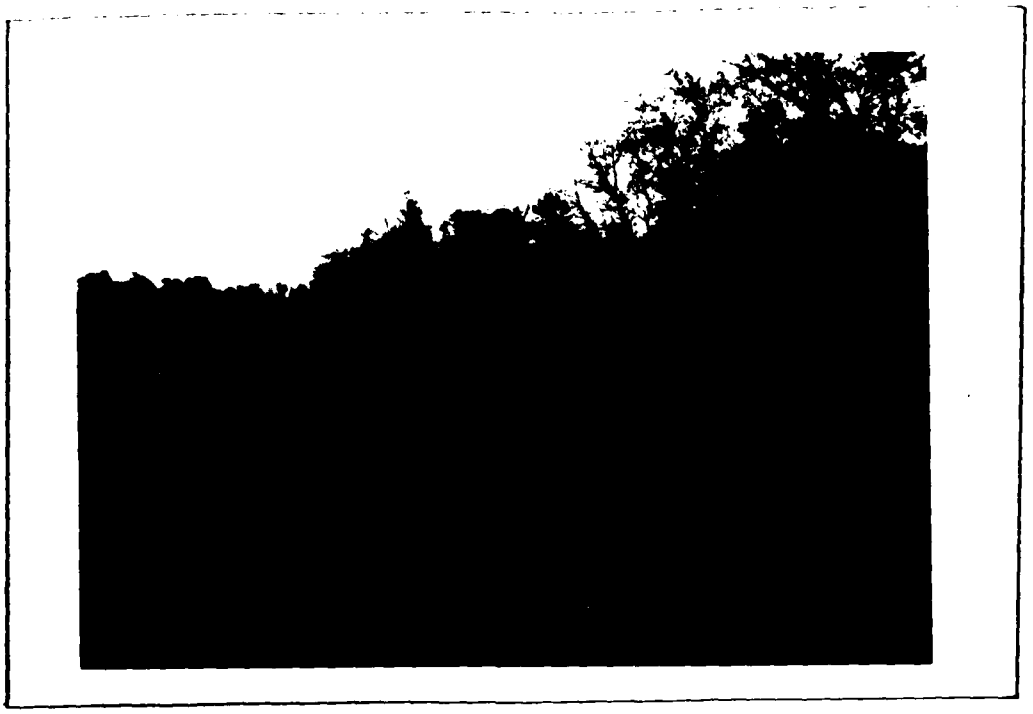
THE LOCATION AND DIRECTION IN WHICH EACH PHOTO WAS TAKEN AND THE NUMBER OF THE PHOTO

NOTE: NOT TO SCALE

1. VIEW OF NORTHWEST SECTION OF EMBANKMENT SHOWING TREES AND BRUSH, BARE SPOTS, DROP INLET AND DOWNSTREAM HAZARD AREA.



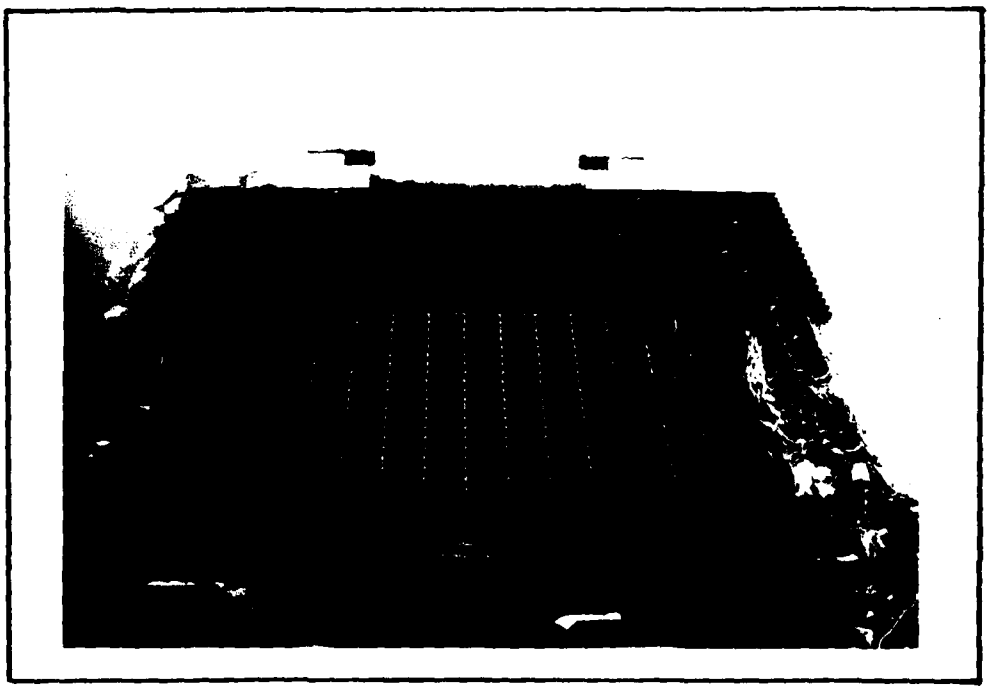
2. VIEW OF NORTHEAST SECTION OF EMBANKMENT SHOWING TIMBER RETAINING WALL, LACK OF VEGETATIVE COVER AND EVIDENCE OF SUBSIDENCE (NEAR CROSSWALK SIGN). RESTAURANT WHICH WOULD BE INUNDATED BY DAM OVERTOPPING IS SHOWN IN BACKGROUND. (4/30/81)



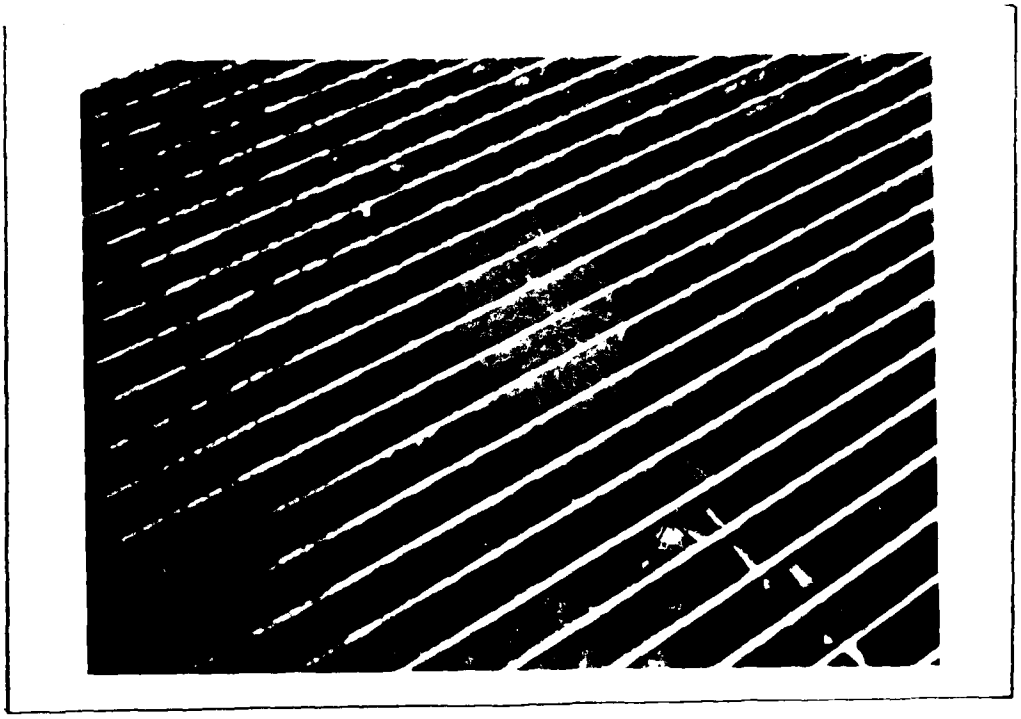
3. VIEW OF IMPOUNDMENT AND SOUTHWEST SECTION OF DAM SHOWING TREES ON EMBANKMENT. (4/30/81)

4. VIEW LOOKING SOUTH ALONG CREST OF SOUTHWEST EMBANKMENT SECTION SHOWING ALIGNMENT, TREES AND SLOPES.

5. CLOSE-UP OF TYPICAL TREES ON SOUTHWEST EMBANKMENT. (4/30/81)



6. VIEW OF SPILLWAY DROP INLET SHOWING TRASHRACK AND WEIR NOTCH WITH STOPLOGS. (4/30/81)



7. VIEW OF INVERT OF DROP INLET SHOWING TRASH ACCUMULATION. (4/30/81)

8. VIEW OF 3 FT. BY 3 FT. BOX CULVERT OUTLET AND SPILLWAY DISCHARGE CHANNEL. (4/30/81)

9. VIEW OF EROSION DUE TO FOOT TRAFFIC ADJACENT TO RIGHT SIDE OF SPILLWAY. (4/30/81)

10. VIEW OF DOWNSTREAM CHANNEL AND HAZARD AREA ABOUT 100 FT. FROM DAM.

11. VIEW OF LAKE MISHE-MOKWA DAM UPSTREAM FROM BALLINGER LAKE. (4/30/91)

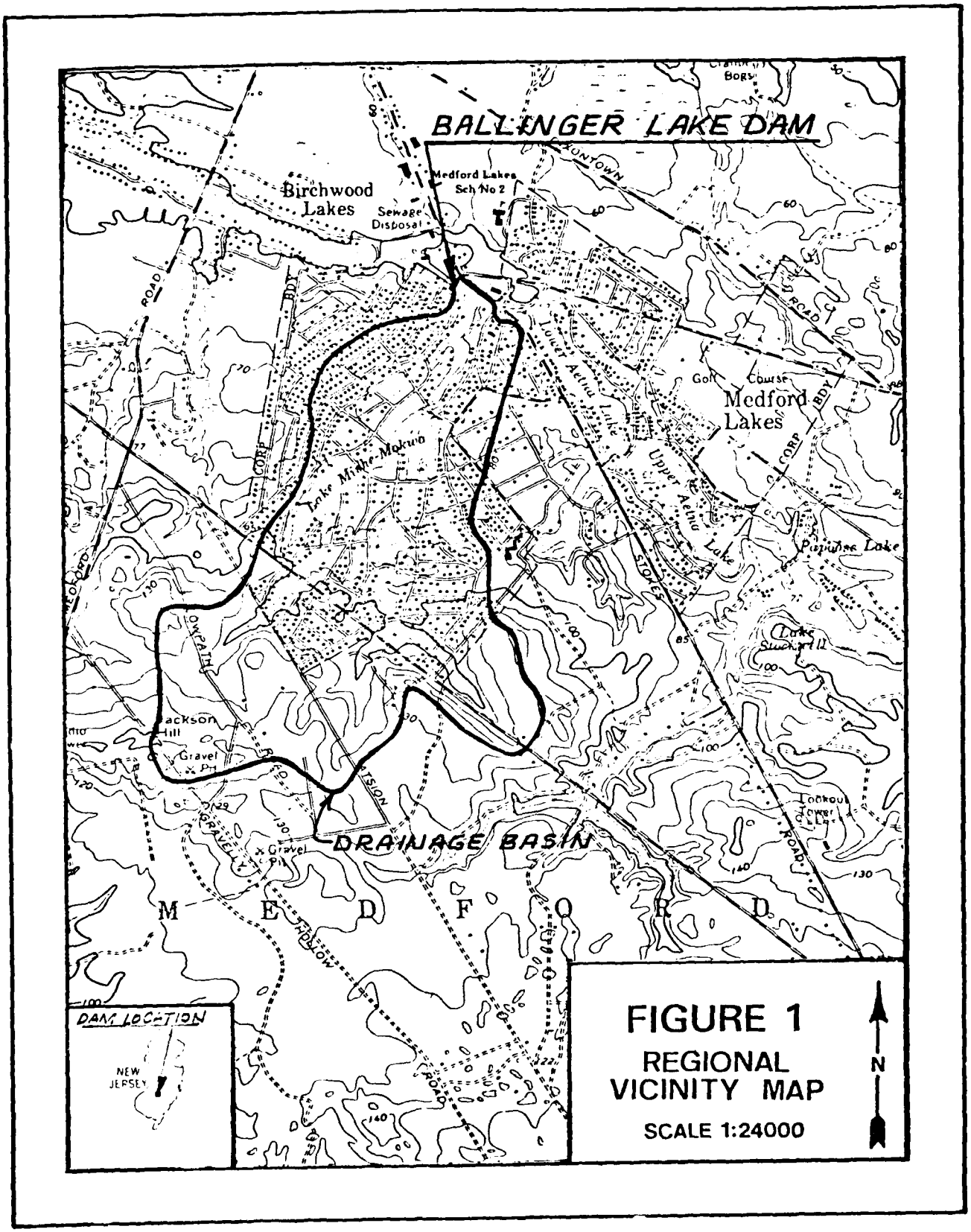
APPENDIX

E

Drawings

BALLINGER LAKE DAM
APPENDIX E
DRAWINGS

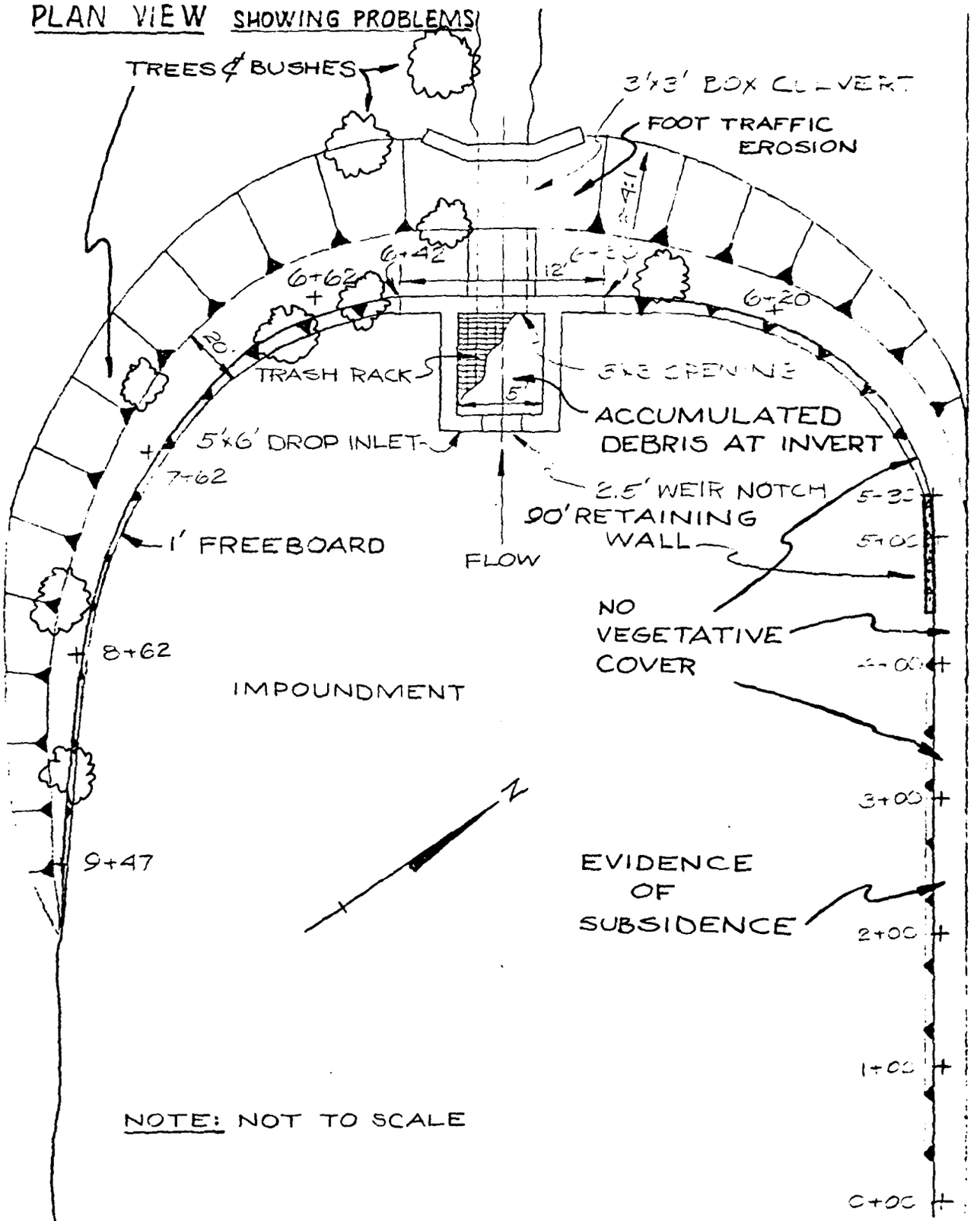
TABLE OF CONTENTS


BALLINGER LAKE DAM
Birchwood Lakes
Sewage Disposal
Medford Lakes Sch No 2
Medford Lakes
Golf Course
Lake Mirthe-Makwa
Lower Aetna Lake
Upper Aetna Lake
Pine Lake
Lake Stuckert
Jackson Hill Gravel Pit
Gravel Pit
DRAINAGE BASIN
MEDFORD
DAM LOCATION
NEW JERSEY
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N

O'BRIEN & GERE ENGINEERS, INC

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	2	RAB	6/18/81	1800-[illegible]-1.4

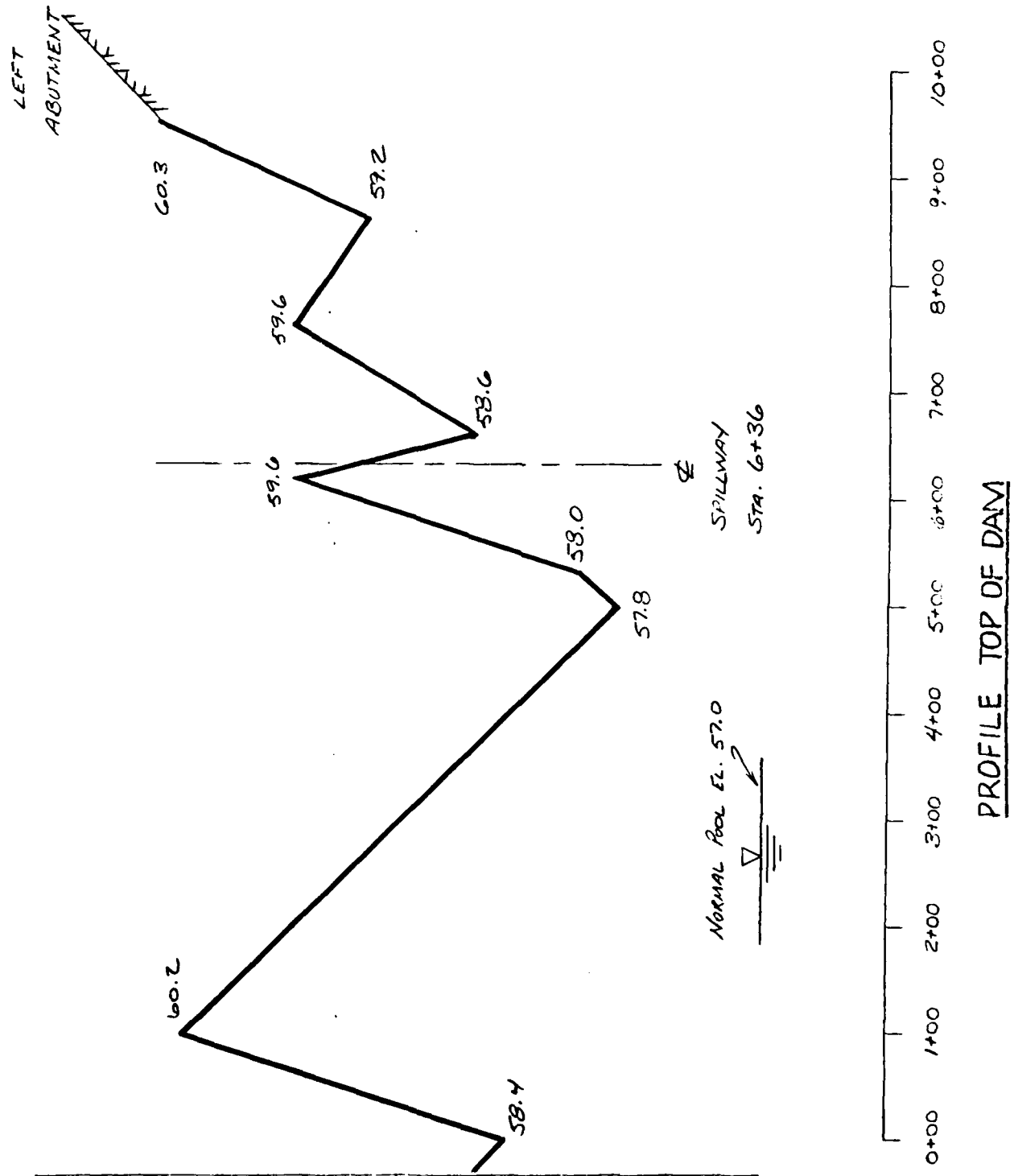
PLAN VIEW SHOWING PROBLEMS



NOTE: NOT TO SCALE

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	3	JFR	6-18-81	1800-006-114

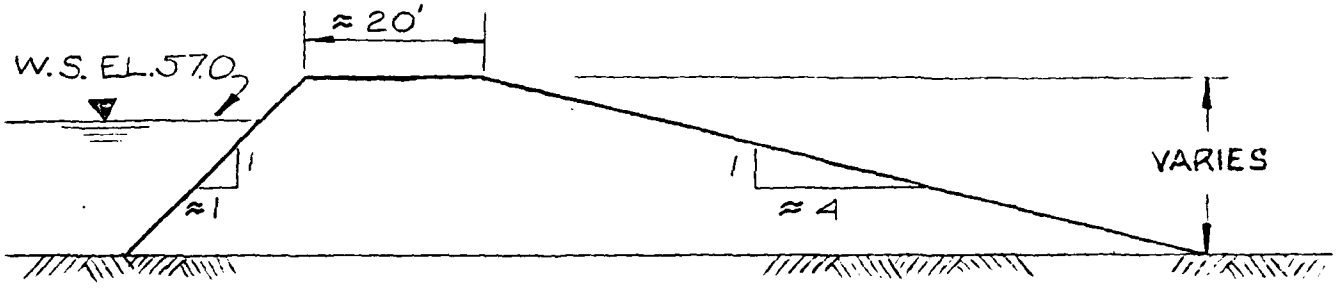


PROFILE TOP OF DAM

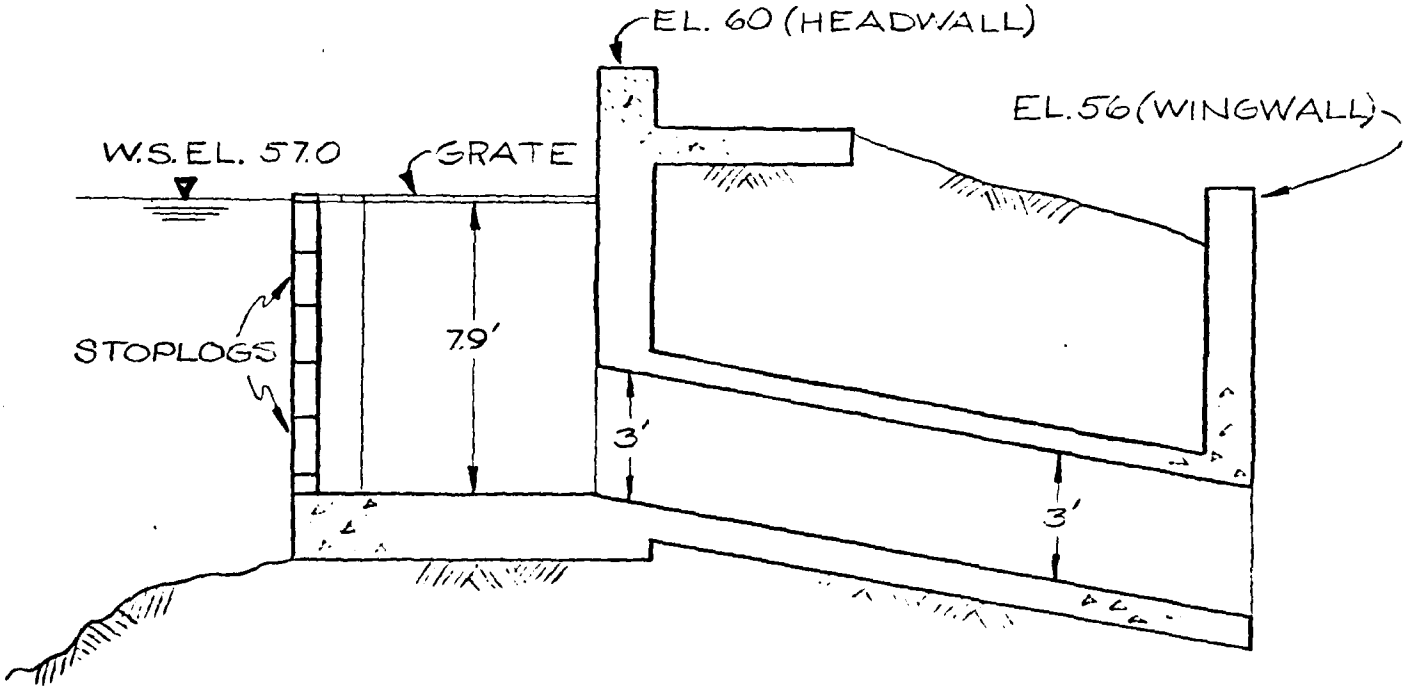
O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
BALLINGER LAKE DAM	4	RAB	6/19/81	1800-006-114

TYPICAL EMBANKMENT SECTION



SPILLWAY DROP INLET CROSS SECTION



NOTE: NOT TO SCALE

APPENDIX

F

Site Geology

SITE GEOLOGY

BALLINGER DAM

Ballinger Dam is situated in Burlington County within the Atlantic Coastal Plain physiographic province. The dam and lake rest on marine and transitional sediments of the Kirkwood formation Tertiary age. The Kirkwood formation consists of sandy silts, some carbonaceous matter and micaceous fine sands. The unit strikes about N.65^{0}E. and dips about 20 feet to the mile in a southeast direction. The project site lies within the outcrop area of the beveled NW edge of the Kirkwood formation. This exposed portion of the formation is considered a part of the recharge zone for the deep "700-foot sand" which acts as a principal aquifer for water supply in the New Jersey coastal zones.

Paleozoic bedrock is estimated to occur at a depth in excess of 1000 feet at the project site.

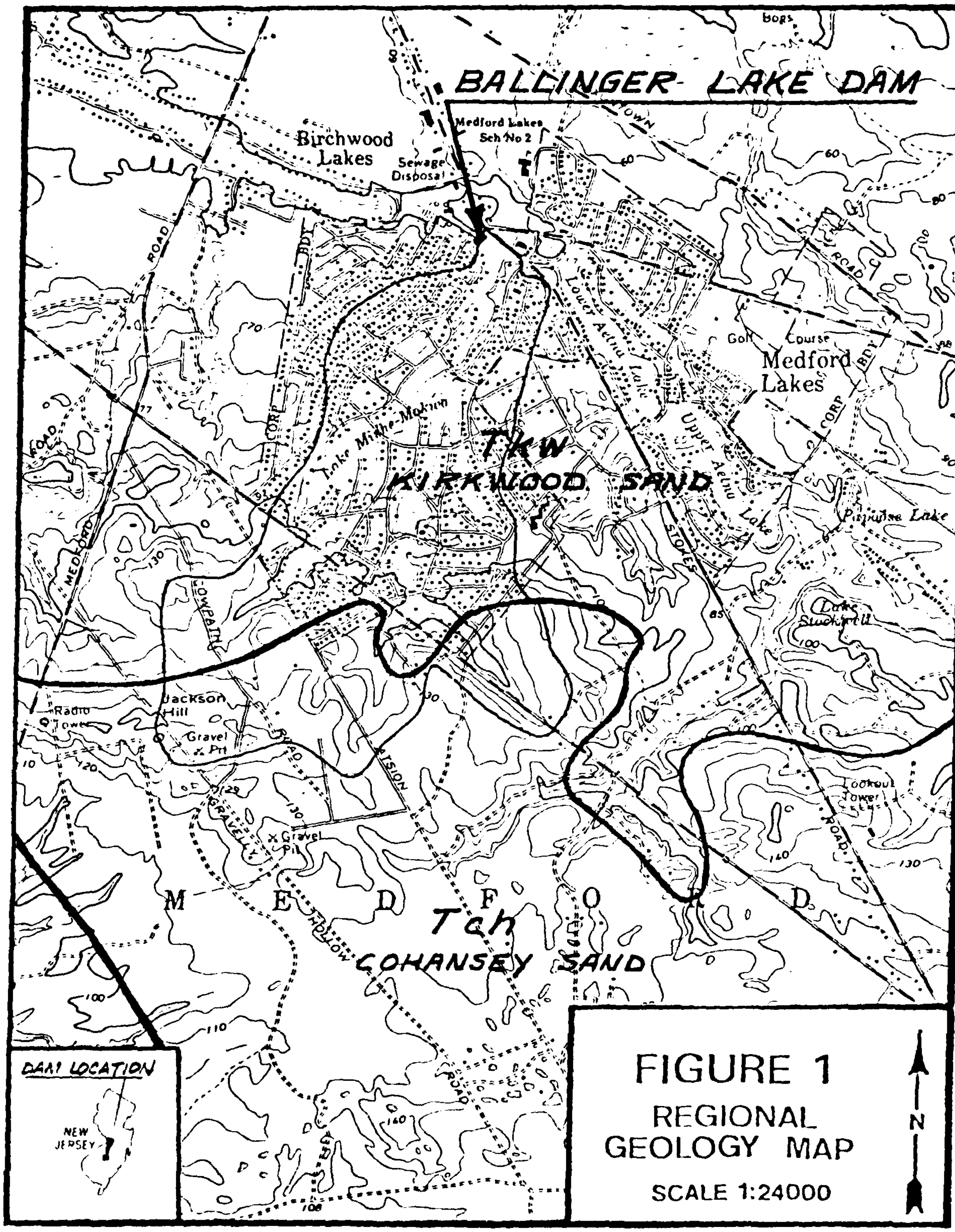


FIGURE 1
REGIONAL GEOLOGY MAP
SCALE 1:24000


N
DAT